Preliminary Comments from Members of the Clean Air Scientific Advisory Committee CASAC Air Monitoring and Methods Subcommittee (AMMS) As Of September 28, 2011

Purpose: To review and provide advice on how to improve EPA's Near Road NO_2 Monitoring Technical Assistance Document.

Preliminary Comments from Members of CASAC AMMS Review Panel

Preliminary Comments from Dr. Linda Bonanno

1) Shouldn't the TAD have a glossary section?

2) Throughout document, important to note which are requirements and which things are not

3) page 4-7: There is a big space before the word data, and it happens in a cople of places on that page, not sure what it means

4) page 10-5: The term Jersey Barrier is used on page 10-5 and then defined on page 11-6, should be vice versa,

5) pg 14-4 4th sentence down.....NOy species present in are dominated... present in what?

6) Also on pg 14-4 at bottom, EPA plans to continue to work with academia, should have a contact at EPA

7) Section 14.4 black (elemental) carbon section, need to define what portion of EC or BC can be said to represent diesel. Not all EC or BC in ambient environment is from diesel...

Preliminary Comments from Dr. Doug Burns

General comments pertinent to Sections 6 and 10:

Response: In general, I believe that this TAD does a good job of providing guidance to monitoring personnel as to how to locate sites and the criteria to use in site selection. My biggest concern is whether adequate guidance or necessary priority has been given to the issue of background NOx emissions and other potential local sources beyond the immediate roadway. It seems that this issue is critical in linking NO2 concentrations to the immediately adjacent roadway. The issue of background and local sources is discussed at various places in the document, but for example, is not listed in Section 6 under "Physical Considerations". Instead, this issue gets raised in Section 10 (10-10 Surrounding Land Use). In my view, the background and other source issues are deserving of mention as a primary site consideration factor in Section 6. I am also uncertain whether consulting emissions inventories will be adequate for this task; number one because these inventories are somewhat out-of-date and number two because there are many sources of NOx such as landfills, wastewater treatment plants, and wetlands that may not be included in inventory data. Additionally, there is no real guidance as to what is meant by "nearby" sources in Section 10-10. What distance or radius should be considered? For example, there is evidence from the literature that overall road density in addition to near road sources provides significant NO2. Shouldn't a measure such as road density also be part of an assessment of monitoring site adequacy?

Charge Question 4: Within Section 6, does the AMMS believe we have adequately described the effects of roadway design, roadway structures, terrain, and meteorology on roadway pollutant dispersion and suggested how those effects can be considered in the near-road site selection process?

Preliminary Response: I found that this Section generally does a good job of discussing the key issues and providing helpful guidance on matters such as barriers, topography, and meteorological conditions. I wonder if guidance should also be offered to avoid (if possible) roadside locations with a high density of mature trees given the evidence shown in Fig. 6-2. I note that the current discussion focuses primarily on noise barriers, but the data in Fig. 6-2 seems to suggest that the presence of mature vegetation along the roadway likely has an even greater effect than does noise barriers.

A second point is whether you might also include in the guidance that where possible, a roadway is selected that is near-perpendicular to the prevailing wind direction. The section already mentions that the downwind side of the road is preferred, but this could vary quite a bit depending on the angle of the road with respect to the dominant wind direction. This would be

criterion to use when deciding among several road segments that are fairly close regarding the other criteria.

Preliminary Comments from Dr. Judith Chow

Charge Question 1: Does the TAD, particularly based upon the information provided in Sections 1 and 2, provide clear objectives of the document and give appropriate rationale for the objectives?

Preliminary Response: Yes, the objectives are adequately stated.

Charge Question 2: Does the AMMS believe that the suggested approach in the TAD places an appropriate amount of weight and consideration on all six factors (AADT, fleet mix, congestion patterns, roadway design, terrain, and meteorology) required to be considered as part of the near-road NO2 site selection process?

Preliminary Response: No. There is too much emphasis on annual average daily traffic (AADT) with fleet mix and congestion modifications and an insufficient discussion of and guidance for the other factors. Notably missing are discussions of human exposure, background NO_2 contributions, and NO_2 transformation potential.

- AADT is discussed on pp. 3-1 to 3-5, pp. 4-2 to 4-4, and pp. 5-9 to 5-14: It seems that >250,000 vehicles/day is overly restrictive. The examples in Table 1 of the TAD (p. 5-12) don't meet this criterion. With this limit, monitoring would be confined to 8 or more lane superhighways that are often elevated or depressed, have a buffer zone around them, and have sound barriers in neighborhoods. Limiting monitoring to these roads would emphasize exposure of other drivers on the road rather than people near the road.
- Fleet mix is discussed on pp. 4-4 to 4-5 and pp. 5-13 to 5-21. The NO_2/NO_x ratio for gasoline vs. old diesel vs. new diesel should be considered in the Fleet Equivalent AADTs. Gasoline engines typically have a ratio of ~5%, while old diesels may have ratios >10%, and new diesels with urea-based SCRs may have ratios as high as 70% (but with much lower total NO_x emissions) (Alvarez et al., 2008; Grice et al., 2009).
- Congestion patterns are discussed on pp. 4-5 to 4-8 and pp. 5-22 to 5-25. The conjecture that congestion is a secondary factor needs to be supported by evidence. One could argue that congested traffic during the rush hours with calm meteorology would minimize turbulence caused by traffic flow, thereby allowing more NO_2 to accumulate at the roadside.
- Roadway design and structures are discussed on pp. 6-2 to 6-7: Figure 6-1 in the TAD (p. 6-5) is a good illustration (the caption needs to describe the wind speed), but more evidence is needed on the effect of road design and structures. It would be useful to study some of these effects using Computerized Fluid Dynamics (CFD) models, as illustrated in Figure 1 below and in other studies (Belalcazar et al., 2010; Gidhagen et al., 2004; Hahn et al., 2009; Karim and Nolan, 2011; Kondo et al., 2006; Kondo and Tomizuka, 2009; Kumar et al., 2009; Sahlodin et al., 2007; Wang et al., 2011; Wang and Zhang, 2009). Street canyons surrounded

by tall buildings have been shown to concentrate and recirculate pollutants that might result in higher concentrations than those measured downwind of a heavily-travelled roadway (Benson et al., 2008; Buccolieri et al., 2011; Cai et al., 2008; Dixon et al., 2006; Eliasson et al., 2006; Gousseau et al., 2011; Grawe et al., 2007; Gromke et al., 2008; Hanna et al., 2006; Lam et al., 2008; Li et al., 2006; Murena et al., 2009; Salmond et al., 2010; Solazzo et al., 2007; Tay et al., 2010; Yassin et al., 2009; Yim et al., 2009; Zhou and Levy, 2008)

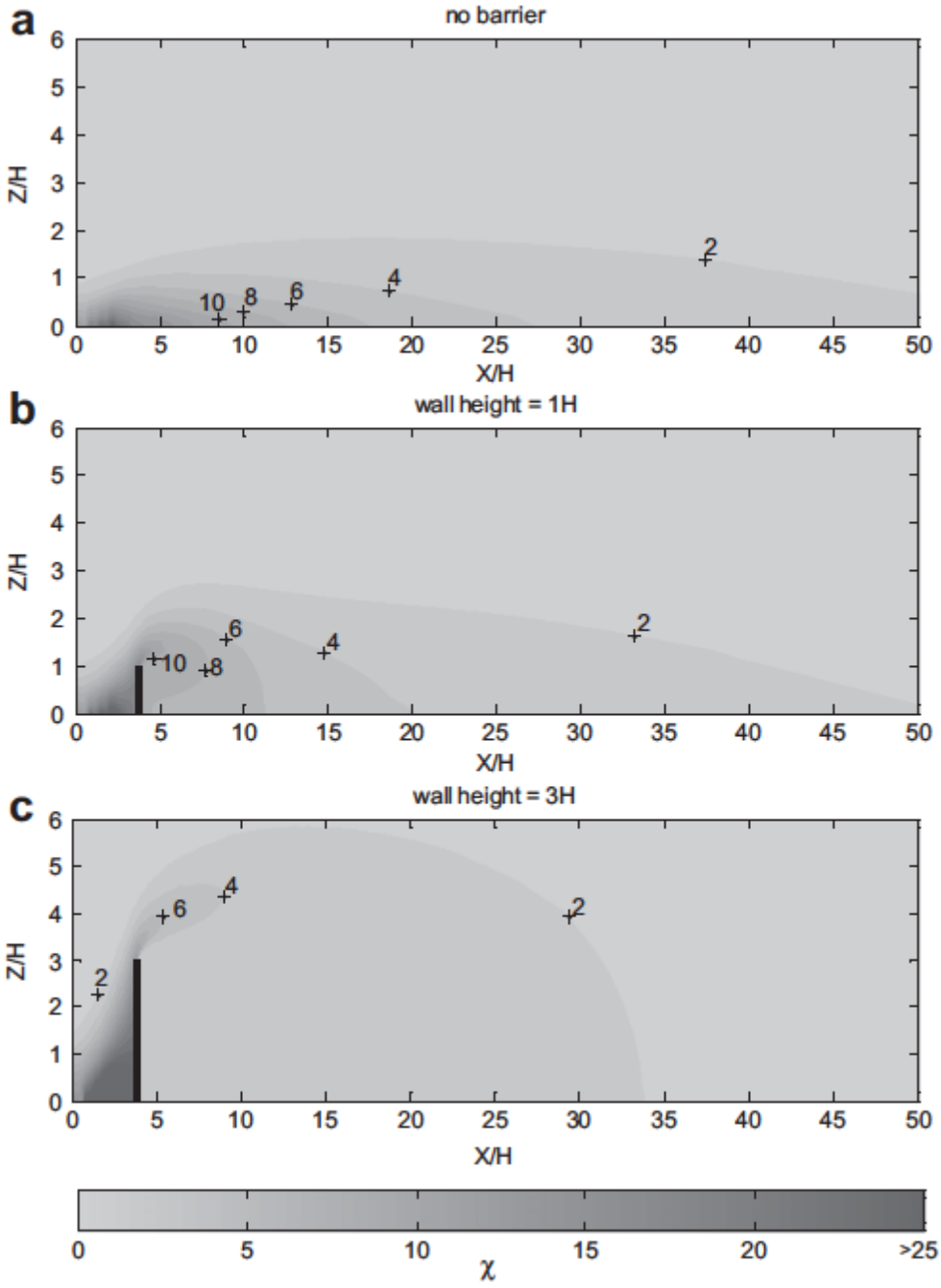

Fig. 4. χ for scenarios with orthogonal winds and cases with no barrier (a), barrier of height *H* (b), and barrier of height 3*H* (c).

Figure 1. Computerized Fluid Dynamics (CFD) Modeling of dispersion downwind of a roadside sound barrier (Hagler et al., 2011). The plume is elevated by the barrier and dispersed on the downwind side.

- Terrain is discussed on p. 6-8: This topic seems highly related to roadway structures.
- Meteorology is discussed on pp. 6-8 to 6-9. Only wind direction is discussed. More needs to be added on the turbulence that would disperse the emissions and the importance of nearby structures (e.g., surface roughness) and moving vehicles in inducing that turbulence.
- Human exposure potential is discussed on pp. 12-2 to 12-3. This should be one of the prime considerations and should be moved to Sections 5 or 6. Why can't the "number of ways" to consider human exposure be "listed here?" It might be that measurements near a bus-stop or transit center on a busy street would yield higher exposures than superhighway emissions, owing to the proximity of the people to the emission sources (e.g., bus exhaust pipes).
- Background concentrations and chemical transformations. The roadside NO_2 will be an increment over the neighborhood- (0.5–4 km) and urban-(4–100 km) scale NO_2 levels (Chow et al., 2002). It may be that a road with lower AADT shows higher levels owing to its proximity to other well-used roads in an urban area. Figures 2 and 3 below are examples of some analyses that would be useful to examine the relationships among the different variables.

The TAD would be more useful if it contained an example that illustrates the different steps in the analysis, along the lines of network design guidance for $PM_{2.5}$ and PM_{10} in U.S. EPA (1997). It starts with a fairly detailed description of AADT and its modifications, with illustrative tables, for the Tampa area, then it becomes less specific for the following steps. The political and population statistical boundaries may be adequate in the eastern U.S., but this is not how air quality management regions are defined in the western U.S. with large counties containing relatively small populated areas surrounded by terrain (Clark County Department of Air Quality and Environmental Management, 2004; Seitz, 2000), or that consist of portions of several counties (SCAQMD, 2011).

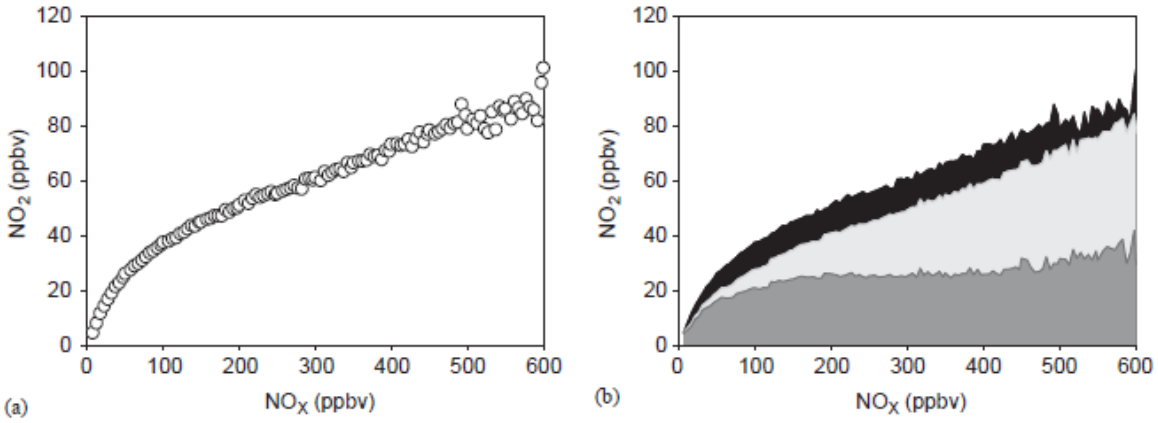

Fig. 2. (a) NO_x–NO_2 relationship for Marylebone Road (1998–2002), (b) NO_x–NO_2 relationship for Marylebone Road highlighting the principal contributors to the NO_2 concentration. The black shading, light grey and dark grey shows the estimated contribution from local NO–O_3 chemistry, primary NO_2 emissions and background air.

Figure 2. Estimation of background, primary emissions, and reacted emissions of NO_2 as a function of NO_x levels along Marylebone Rd. in London (Carslaw and Beevers, 2005).

Reacted NO_2 increases rapidly for NO_x<100 ppb until roadside O_3 is depleted. Background levels are determined from urban-scale monitors.

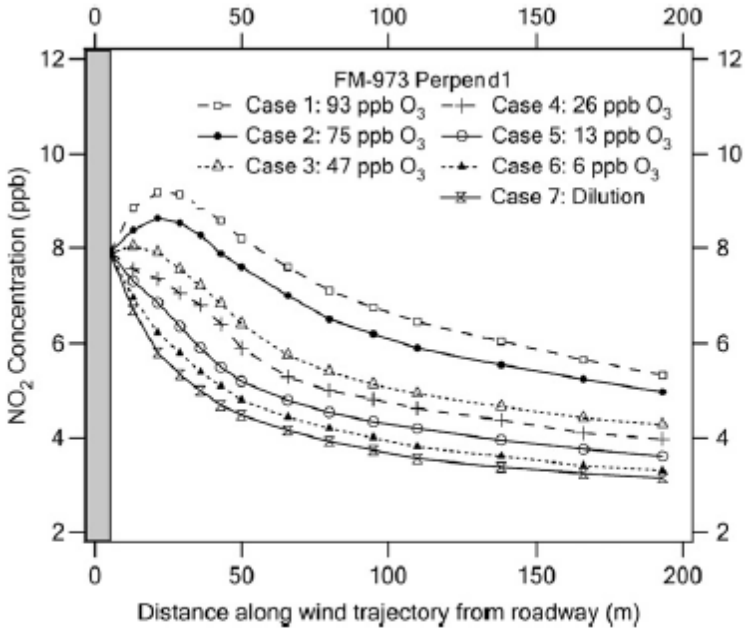

Fig. 6. Comparison of NO_2 concentration profiles under different ozone concentrations and corresponding photolysis rate for FM-973 Perpend1.

Figure 3. Higher NO_2 may be measured further downwind when O_3 is high, as shown by roadside Computerized Fluid Dynamics (CFD) Modeling (Wang et al., 2011).

Charge Question 3: Does the AMMS see opportunities to improve the usefulness of the Fleet Equivalent AADT metric introduced and discussed within Section 5?

Preliminary Response: Yes. See the recommendation under Question 2 to consider the NO_2/NO_x ratio from gasoline- vs. old and new diesel-powered engines.

Charge Question 4: Within Section 6, does the AMMS believe we have adequately described the effects of roadway design, roadway structures, terrain, and meteorology on roadway pollutant dispersion and suggested how those effects can be considered in the near-road site selection process?

Preliminary Response: No. Many statements are made without sufficient support. Figure 6-1 of the TAD (p. 6-5) is useful, but a broader weight of evidence is needed.

Charge Question 5: Within Section 7, does the AMMS believe we have adequately discussed the siting requirements and provided appropriate suggestions for how to properly site monitor probes while considering the design of the target road and/or roadside structures?

Preliminary Response: Existing air quality monitoring sites should be examined first. Are there already existing roadside sites that are likely to represent human exposure? Some analysis of the existing data in the airshed should be performed to determine how well existing monitors represent the desired spatial scales.

Charge Question 6: Does the AMMS believe that Section 8 has adequately discussed and explained the varied approaches on the optional use of exploratory monitoring as part of the near-road site selection process?

Preliminary Response: Middle- (100–500 m) or neighborhood-scale studies would be a better term than "saturation study"

A table outlining some of the instrumentation, accuracy, precision, averaging times, and detection limits with appropriate citations would be useful. Passive NO_2 filter adsorption has been widely studied and its advantages and disadvantages have been investigated (Ayers et al., 1998; Beckerman et al., 2008; Crouse et al., 2009; De Fouquet et al., 2007; Douglas and Beaulieu, 1983; Gilbert et al., 2003; Hauser et al., 2009; Heal et al., 1999; Heal et al., 2000; Heal and Cape, 1997; Henderson et al., 2007; Jimenez et al., 2011; Kirchner et al., 2005; Krochmal and Gorski, 1991; McConnaughey et al., 1985; Mukerjee et al., 2004; Mukerjee et al., 2009; Nash and Leith, 2010; Nishikawa et al., 2009; Norris and Larson, 1999; Ozden and Dogeroglu, 2008; Piechocki-Minguy et al., 2006; Plaisance et al., 2004; Sather et al., 2006; Sekine et al., 2008; Shooter et al., 1997; Sickles, II and Michie, 1987; Van Reeuwijk et al., 1998; Vardoulakis et al., 2009). Several microsensors are available that might be more useful for evaluating where and when high NO_2 levels might occur. There are also several examples of mobile-lab and in-plume monitors that might be useful for determining real-world emission rates and NO_2/NO_x ratios for different engine types (Beckerman et al., 2008; Bukowiechi et al., 2002; Herndon et al., 2004; Johnson et al., 2008; Johnson et al., 2009a; Kittelson et al., 2004; Maciejczyk et al., 2004; Morawska et al., 2007; Nussbaum et al., 2009; Pirjola et al., 2004; Pirjola et al., 2006; Pirjola et al., 2009; Shorter et al., 2005; Wang et al., 2009a; Yli-Tuomi et al., 2005; Zavala et al., 2006; Zhu et al., 2009).

Charge Question 7: Within Section 9, does the AMMS see opportunities to improve the description of how the (optional) use of AERMOD and MOVES can be used to conduct dispersion modeling in the near-road site selection process?

Preliminary Response: A more concrete example would be useful. Other models and data analysis methods might be more accurate than AERMOD for the middle-scale, as suggested under Question 2.

Charge Question 8: Within Section 10, does the AMMS believe the list of items needed to appropriately characterize individual candidate road sites is complete and adequately described? If the list is considered incomplete, please provide a list of the missing characteristics that should be included.

Preliminary Response: This seems repetitive of Sections 4, 5, and 6 except for the safety issues. A checklist or outline for site documentation might be more useful.

Charge Question 9: From an air agency perspective, does the AMMS find that the definitions and explanation of transportation agency policies and expectations are adequate? Are there opportunities to improve upon the material presented within this section?

Preliminary Response: No comment.

Charge Question 10: Does the AMMS have ideas for improvement with respect to the organization and usefulness of the suggested site comparison matrix discussed within Section 13?

Preliminary Response: Table 8 of the TAD (p 12-5) should include all of the considerations listed under Question 2. The focus is too much on the roadway while it is a combination of variables that influences concentrations and exposures.

Charge Question 11: Does the AMMS:

a. Concur with the order of presentation of each pollutant or metric of interest in the near-road environment, as was suggested by the previous AMMS panel, within Section 14?

Preliminary Response: The priority monitoring should be: 1) NO_2/NO; 2) wind speed and direction; 3) O_3; 4) BC; 4) particle number; 5) CO_2; 6) CO; 7) $PM_{2.5}$ or PM_{10} mass (or surrogate);

8) toxics; 9) lead; 10) SO_2; and 11) OC. Priorities 1 and 2 are obvious. The NO_2/NO ratio will be highly related to O_3, so this is the next priority. BC is a good indicator of both primary emissions and high emitters and is relatively easy to measure and analyze data with an aethalometer (Hansen and Mocnik, 2010). Particle number is an emerging health indicator with a variation of its measurement to be used for future European (and possibly U.S.) engine certification (Dwyer et al., 2010a; Dwyer et al., 2010b; Giechaskiel et al., 2008; Johnson et al., 2009b; Wang et al., 2010). An inexpensive fast-response CO_2 monitor would allow fuel-based emission factor distributions to be estimated from the other short-duration measurements (Sawyer et al., 2000; Sawyer, 2010). CO is less of an issue with modern engine technology, but it may result from high emitters (Bishop and Stedman, 2008). An optical particle counter (Peters et al., 2006; Wang et al., 2009b) for PM would be more useful than a filter compliance sampler to estimate the distribution of fuel-based emission factors. Toxics, lead, SO_2, and OC would not probably be worth the expense for modern fuels.

b. Concur with the description of each pollutant or other metric discussed in Section 14, including its impact on human health (as appropriate), the reason for interest in the near-road environment, and the description or suggestions for measurement?

Preliminary Response: See answer above for importance of each measurement. There is a lack of balance in the measurement descriptions, with NO_x receiving more emphasis than others. An update of U.S. EPA (1998a; 1998b) guidance might be useful and incorporated by reference.

c. Believe that a pollutant or other metric should be removed from the list within Section 14, or that an unlisted item should be included within this section?

Preliminary Response: Traffic counters and video cameras are unnecessary. Who would examine these data and how would they used to enhance understanding of the measured concentrations?

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Preliminary Comments from Dr. Kenneth Demerjian

General Comments:

In reviewing the TAD in its entirety, it falls short of addressing the principal goal of deploying near-road NO2 monitoring which is to identify neighborhood populations at risk to high exposures of NO2 concentrations due to their proximity to major roadways. This is different from the over-arching objective identified in the TAD "…placing monitor probes as near as practical to highly trafficked roads where peak NO2 concentrations are expected to occur…." The intersection of AADT and CBSA is a rather crude filter that is unlikely to identify high pollutant exposure risk neighborhoods in proximity to major roadway segments. The subject of traffic related exposures is discussed extensively in the HEI Special Report 17 "Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects," a reference conspicuously missing in this document.

Specific comments to assigned charge question.

Charge Question 3: Does the AMMS see opportunities to improve the usefulness of the Fleet Equivalent AADT metric introduced and discussed within Section 5?
Preliminary Response: The Fleet Equivalent AADT metric described in Section 5 of the TAD is a reasonable first step for triaging hot spot roadway segments for potential NO2 monitoring, but is unlikely to identify specific local hot spot pollutant exposures at the roadway/neighborhood intersection. Before implementation of the FE-AADT as a screening tool, several uncertainties in the approach should be addressed.

1) HD emissions will vary with the age of the vehicle fleet which likely varies within CBSA and by region. Emissions from HD fleets are not routinely monitor like the LD fleet and aged HD vehicles are likely more affected by gross emitters. Estimates of the uncertainties in HD emissions and their potential impact on local hot spot exposures should be documented across typical CBSAs under consideration.
2) A quantitative treatment of traffic congestion must be developed as it is a critically important component to exposure assessment. The LOS ranking A-F as applied in section 5.3 has no power and does not provided any specificity to distinguish within the F ranking. Dismissing the quantitative treatment of traffic congestion based on these results is not acceptable and more effort needs to be made to address the congestion metric.

HEI Special Report 17, (2010). Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects http://pubs.healtheffects.org/view.php?id=334.

Preliminary Comments from Mr. Dirk Felton

Charge Question 1: Does the TAD, particularly based upon the information provided in Sections 1 and 2, provide clear objectives of the document and give appropriate rationale for the objectives?

Preliminary Response: The objective of finding a suitable location for a near road monitor is well covered. The TAD is missing all of the reasoning behind the network design, the scientific overview of pollutant interactions and a discussion on the limitations of the data resulting from this network. The most important issue in near road monitoring is understanding the gradient of NO_2 and other mobile source pollutants in relation to distance from the edge of the road. There should be recommendations to make inlet distance from the road and height above the road way as equivalent as possible particularly for sites within the same CBSA. If these distances are not equivalent, the data will be less useful for comparisons between sites. There should also be a discussion of the importance of having a nearby non near-road population exposure monitor so that the significance of the near road concentrations can be evaluated.

Charge Question 2: Does the AMMS believe that the suggested approach in the TAD places an appropriate amount of weight and consideration on all six factors required to be considered (AADT, fleet mix, congestion patterns, roadway design, terrain, and meteorology) as part of the near-road NO2 site selection process?

Preliminary Response: The TAD only looks at these factors because the regulation is too focused on the emissions from segments of individual roadways. The effects of multiple roadways in dense urban areas can often lead to higher NO_2 concentrations than can be observed near the edge of a single heavily trafficked road. The on-going New York Community Air Survey, which is referenced in Section 8.1.1, utilizes passive samplers to clearly show that NO_2 levels are higher in the center of Manhattan than near the edge of the roadways with higher AADT.

The regulation and the supporting TAD should be flexible enough to permit and encourage monitor siting at the locations where the NO_2 levels are expected to have the greatest impact on human health.

Charge Question 3: *Does the AMMS see opportunities to improve the usefulness of the Fleet Equivalent AADT metric introduced and discussed within Section 5?*

Preliminary Response: The FE metric is an acceptable approach for initially ranking road segments based on combined LD and HD traffic counts. The accuracy, however, of a national default value must be determined. Different regions have older or newer LD and HD fleets, more or less extensive clean diesel campaigns, road segments with low or steep grades and different degrees of congestion on road segments. All of these factors will affect the FE value for a particular CBSA. Some States and other research programs

have performed remote sensing campaigns on multiple road segments within a CBSA. The data from these segments can be compared to the expected emissions based on known LD and HD traffic counts during the monitoring campaign in order to provide an estimate of the accuracy of the HD multiplier.

The EPA should review existing research study results and consolidate the HD multiplier values determined by roadside monitoring from as many different CBSAs as possible. Having this information available will provide monitoring agencies with a reasonable estimate of FE accuracy. Monitoring agencies can use the FE accuracy to determine how precisely they should follow the rankings produced by the FE metric. This will allow for the importance of FE ranking to be matched to other available factors affecting site selection.

The FE metric is going to be more useful in the larger CBSAs where the LD and HD traffic are often segregated to some extent based on tolls, weight restrictions or outright prohibitions for HD vehicles such as on New York City's Parkways. In smaller CBSAs where there are fewer transportation routes, it is likely that the FE will not significantly impact NO_2 near-road site selection.

Charge Question 4: Within Section 6, does the AMMS believe we have adequately described the effects of roadway design, roadway structures, terrain, and meteorology on roadway pollutant dispersion and suggested how those effects can be considered in the near-road site selection process?

Preliminary Response: In the terrain and meteorology sections the proximity to water bodies is not covered adequately. Urban areas and major roads are often built alongside the rivers and seashores that initially encouraged development in these areas. Monitoring in these river valleys and along the shores of large water bodies will tend to reduce the concentrations of locally emitted pollutants in comparison to sites away from the influence of these water bodies.

Charge Question 5: Within Section 7, does the AMMS believe we have adequately discussed the siting requirements and provided appropriate suggestions for how to properly site monitor probes while considering the design of the target road and/or roadside structures?

Preliminary Response: The allowance for wall mounted inlets is puzzling. The wall, even at 1 meter spacing will still represent a barrier to air movement and will trap pollutants between the inlet and the roadway. The use of a site with this type of inlet will also preclude the use of this site for other mobile source related pollutants such as PM $\geq$ 2.5 microns which require vertical inlets. These wall mounted inlets should only be permitted in areas where no other sites are possible and where only limited supplemental measurements are anticipated.

Charge Question 6: Does the AMMS believe that Section 8 has adequately discussed and explained the varied approaches on the optional use of exploratory monitoring as part of the near-road site selection process?

Preliminary Response: The TAD omits how the information from exploratory monitoring should be weighted in relation to the other factors.

Charge Question 7: Within Section 9, does the AMMS see opportunities to improve the description of how the (optional) use of AERMOD and MOVES can be used to conduct dispersion modeling in the near-road site selection process?

No Preliminary Response

Charge Question 8: Within Section 10, does the AMMS believe the list of items needed to appropriately characterize individual candidate road sites is complete and adequately described? If the list is considered incomplete, please provide a list of the missing characteristics that should be included.

Preliminary Response: The section barely touches on surrounding land use. This category should be expanded to include population exposure as well as how wide an area a specific site represents. Sites that can be said to represent a significant length of a roadway or similar nearby roadways should be considered to be more valuable than a monitor that only represents a single road segment.

Charge Question 9: From an air agency perspective, does the AMMS find that the definitions and explanation of transportation agency policies and expectations are adequate? Are there opportunities to improve upon the material presented within this section?

Preliminary Response: The legal requirement to install a near road monitoring site should be explicitly included in the TAD.

Monitoring agencies should consider installing traffic cameras at each near-road site or asking the local DOTs to include these sites in their system. Having this information readily available will assist with the validation of outlier 1-Hr NO_2 data after these sites begin collecting data. In dense urban areas, accidents, vehicle fires, road maintenance, snow removal activities and mowing can all have significant short-term impacts on NO_2 concentrations.

Charge Question 10: Does the AMMS have ideas for improvement with respect to the organization and usefulness of the suggested site comparison matrix discussed within Section 13?

Preliminary Response: The site selection matrix is a very idealized version of the way sites are likely to be selected by today's under staffed, over worked and underfunded monitoring agencies. Candidate sites that run into a road block such as an access, lease

cost or safety issue will be dropped from consideration and it would be a waste of time to continue to research the site/segment parameters necessary to complete the matrix.

It is preferable to encourage the detailed site segment information to be collected for an Agency's most promising 2-4 locations for each CBSA. The effort to collect this information is only warranted if the sites are feasible and are likely to be approved by the local DOT and EPA.

The advantage to having several candidate sites in each CBSA fully evaluated is that the sites that are ultimately not selected for near road NO_2 monitoring are essentially pre-approved as back up monitoring locations. Urban monitoring locations are often impacted by road and bridge construction, building construction and other urban planning initiatives. Many of these installed near road sites will have to be relocated within the next 5-10 years and it would be sensible to maintain a short list of acceptable replacement sites.

Charge Question 11: Does the AMMS:
a. Concur with the order of presentation of each pollutant or metric of interest in the near-road environment, as was suggested by the previous AMMS panel, within Section 14?

Preliminary Response: Air Toxics should be moved up in order of relevance. These compounds are likely to be much more valuable to the monitoring and health communities.

b. Concur with the description of each pollutant or other metric discussed in Section 14, including its impact on human health (as appropriate), the reason for interest in the near-road environment, and the description or suggestions for measurement?

Preliminary Response: The discussion of PM number concentration should include a discussion of size distribution, inlet configuration and inlet uniformity from site to site.

The PM section should clearly indicate that the short comings of both the FRM and the FEMs will be more pronounced in the near road environment.

The OC section should include a caveat that states the limitation of the STN carbon sampler. This sampler is optimized for use in rural areas as part of the visibility program. It is not as useful for capturing the higher proportion of semi-volatile OC expected to be prevalent in the near-road environment.

c. Believe that a pollutant or other metric should be removed from the list within Section 14, or that an unlisted item should be included within this section?

Preliminary Response: PM-2.5 should be removed from the list until a method is approved that is better able to handle semi-volatile PM.

Preliminary Comments from Dr. Phil Fine

Charge Question 2: Does the AMMS believe that the suggested approach in the TAD places an appropriate amount of weight and consideration on all six factors (AADT, fleet mix, congestion patterns, roadway design, terrain, and meteorology) required to be considered as part of the near-road NO2 site selection process?

Preliminary Response: In general, yes. In practice, AADT and fleet mix should be the driving factors for choosing candidate sites (i.e. total NOX emissions), and then logistics will be the driving factor in making final selections.

Charge Question 3: Does the AMMS see opportunities to improve the usefulness of the Fleet Equivalent AADT metric introduced and discussed within Section 5?

Preliminary Response: The factor of 10 is a reasonable default, but many areas should have mobile source NOx inventories that should provide a more accurate factor.

Charge Question 9: From an air agency perspective, does the AMMS find that the definitions and explanation of transportation agency policies and expectations are adequate? Are there opportunities to improve upon the material presented within this section?

Preliminary Response: The discussion in this area is understandably brief, since requirements in different states will be different. While this section may help states get the approval process started, it may not help when state-specific requirements and restrictions are encountered. What would help is a national and regional EPA outreach effort to FHWA and state DOTs to highlight the importance of the program and prepare them for the access requests. Another option that should be mentioned is private or publicly owned land within 50 meters that is not DOT controlled. Permissions and approvals may be much easier in these locations.

Charge Question 10: Does the AMMS have ideas for improvement with respect to the organization and usefulness of the suggested site comparison matrix discussed within Section 13?

Preliminary Response: I believe this question refers to section 12.3. I suggest inclusion or the availability of a sample matrix rather than just a description of the parameters to put in the matrix.

Preliminary Comments from Dr. Rudolf Husar

Charge Question 1: Does the TAD, particularly based upon the information provided in Sections 1 and 2, provide clear objectives of the document and give appropriate rationale for the objectives?

Preliminary Response: The TAD contains a set of well-structured technical instructions and guidelines for the location selection of the roadway monitoring sites. However, the TAD does not offer a well-defined criteria for the 'optimal' site, nor for the optimization in general.

Buried in a paragraph on page 4-6**: the objective of the monitoring effort is to characterize the peak NO2 concentrations that are occurring in the area**.. Is finding and 'characterizing' the peak hourly near-road NO2 the siting optimization criteria?

Charge Question 2: Does the AMMS believe that the suggested approach in the TAD places an appropriate amount of weight and consideration on all six factors required to be considered (AADT, fleet mix, congestion patterns, roadway design, terrain, and meteorology) as part of the near-road NO2 site selection process?

Preliminary Response: Why is the distance to the source not a major factor? It is an exponential factor. The recommended 20-50 m distance and 2-7m in elevation covers a wide range of constrictions near the road and introduces considerable ambiguity in attaching meaning to the measurement

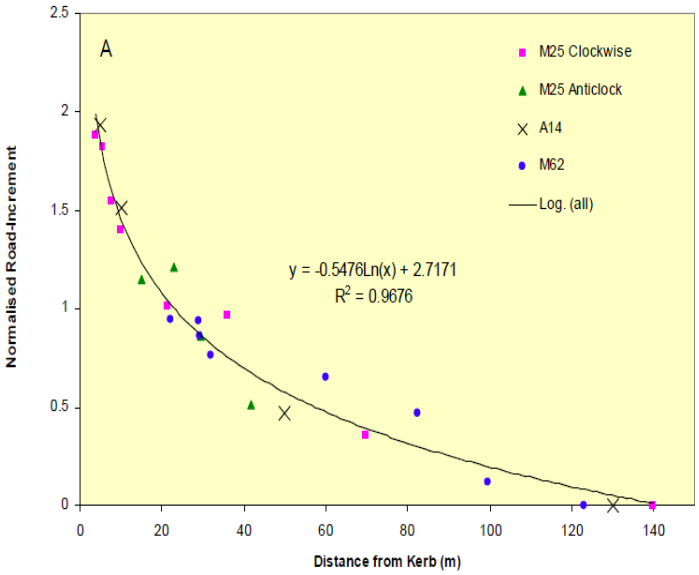
Charge Question 3: Does the AMMS see opportunities to improve the usefulness of the Fleet Equivalent AADT metric introduced and discussed within Section 5?

Preliminary Response: He formula makes sense. The data for the fleet mix is the problem. The diurnal, weekly, seasonal cycles of the mix, particularly for the HD vehicles is hard to get. So, little info is available for the source of the NO2 near the road.

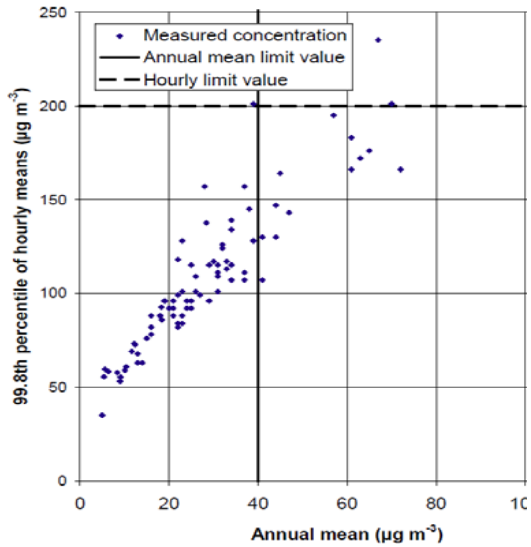
Charge Question 4: Within Section 6, does the AMMS believe we have adequately described the effects of roadway design, roadway structures, terrain, and meteorology on roadway pollutant dispersion and suggested how those effects can be considered in the near-road site selection process?

Preliminary Response: It is made way too complicated in TAD. As if there were no

regularities but randomness everywhere. Here are two charts from R Poirot's comments in the Nov 2010 review:



.3. Plot of annual mean against 99.8th percentile hourly NO_2 conc



Left Chart: The concentration of roadway emissions (normalized to 20m distance) declines exponentially. The closer you get to the source, the higher the concentration. Is this law of dispersion different in the US?

Right Chart: The annual average and the 98% hourly data correlate well. The slope may vary some, but it provides a useful guide.

Charge Question 5: Within Section 7, does the AMMS believe we have adequately discussed the siting requirements and provided appropriate suggestions for how to properly site monitor probes while considering the design of the target road and/or roadside structures?

Preliminary Response: As seen on the above chart (Left), between 20 and 50 m distance from the 'kerb', the concentration declines by a factor of two. At 2 meters from the kerb (truck) the NO2 concentration is higher by a factor of two. In other words, a person in the car on the same lane as the trucks is exposed to a concentration four times that of the sampler at 50m. So which is the relevant concentration, at the location of the drivers or the arbitrary location of the sampler?

Also, how would one establish an exceedance? Normalize all the data to the 20m distance? Can such a procedure withstand legal scrutiny?

Charge Question 6: Does the AMMS believe that Section 8 has adequately discussed and explained the varied approaches on the optional use of exploratory monitoring as part of the near-road site selection process?

Preliminary Response: The section discusses several exploratory monitoring options: saturation study; focused monitoring campaign and mobile monitoring. A 'Saturation study" or a more sophisticated "Multi-scale" monitoring study would be helpful if dispersion from roadway emissions roadway emissions was a new topic. I would recommend reading and analyzing the existing studies.

Focused monitoring program may be helpful to verify physical and/or empirical dispersion models (e.g. the above chart). Mobile monitoring over a specific candidate road segment would be terrific if combined with model(s) and the planned monitoring site. Driving up-end down the road segment could establish the relationship between the ambient concentration over the roadway and the chosen monitoring site.

Charge Question 7: Within Section 9, does the AMMS see opportunities to improve the description of how the (optional) use of AERMOD and MOVES can be used to conduct dispersion modeling in the near-road site selection process?

Preliminary Response: Models should be companions to the monitoring and complement the

observations. Clearly, chemical kinetics is superfluous; even the aerosol size distribution is frozen right after the tailpipe (coagulation is a second order process). EPA should recommend a specific simple modeling procedure similar to this TAD.

Charge Question 8: Within Section 10, does the AMMS believe the list of items needed to appropriately characterize individual candidate road sites is complete and adequately described? If the list is considered incomplete, please provide a list of the missing characteristics that should be included.

Preliminary Response: The Agency is to be commended for recommending the use of new digital recourses for evaluating and characterizing candidate monitoring sites. One-foot resolution satellite images along with mapping tools like Google Earth provide a simple and relevant view of the roadways, 3D terrain, surrounding environment, etc. At the resolution of these maps, distance measurements can also be performed. Furthermore, virtually all US urban areas are now documented with thousands of geo-referenced photographs that are shared through Paronamio, Flickr and other photo-sharing websites that can be displayed on maps. The combination of these resources can resolve many of the questions related to:

Road Segment Identification

Road Segment Type

Road Segment End Points

Interchanges

Roadway Design

Terrain

Roadside Structures

With these electronic resources, the burden placed on the air managers and the DOT offices can be considerably reduced.

Preliminary Comments from Dr. Daniel Jacob

Charge Question 1: Does the TAD, particularly based upon the information provided in Sections 1 and 2, provide clear objectives of the document and give appropriate rationale for the objectives?

Preliminary Response: Yes.

Charge Question 2: Does the AMMS believe that the suggested approach in the TAD places an appropriate amount of weight and consideration on all six factors required to be considered (AADT, fleet mix, congestion patterns, roadway design, terrain, and meteorology) as part of the near-road NO2 site selection process?

Preliminary Response: I'm surprised that little weight is given to background NO2. This background could be of great importance considering that the 1-h NAAQS is 100 ppb but urban NO2 concentrations upwind of the roadway can easily be tens of ppb. The TAD recognizes the importance of background NO2 as provided by point sources upwind, but this may be less relevant than the network of other roadways in the urban area. An isolated roadway with high AADT may have lower roadside NO2 than a downtown roadway with lower AADT.

I don't understand why below-grade highways would cause less near-road NO2 than at-grade highways. Under stable conditions, elevated NO2 could pool in the depressed roadway bed and eventually spill in the surrounding area, causing higher concentrations than an at-grade highway would.

Meteorology is not important for transport alone. NO-NO2 chemistry is coupled to meteorology through availability of ozone, solar radiation, and NO to NO2 conversion time (translating into distance from roadway), it seems to me that some work is needed using a plume dispersion model with NO-NO2 chemistry (such as AERMOD) to identify the worst meteorological conditions for NO2 and provide general guidance to local agencies on this matter. The worst meteorological conditions for an inert pollutant may not be necessarily be the worst for NO2.

Charge Question 3: Does the AMMS see opportunities to improve the usefulness of the Fleet Equivalent AADT metric introduced and discussed within Section 5?

Preliminary Response: Looks good to me, I'm no expert.

Charge Question 4: Within Section 6, does the AMMS believe we have adequately described the effects of roadway design, roadway structures, terrain, and meteorology on roadway pollutant dispersion and suggested how those effects can be considered in the near-road site selection process?

Preliminary Response: I think this could be improved. See my response to Charge Question 2.

Charge Question 5: Within Section 7, does the AMMS believe we have adequately discussed the siting requirements and provided appropriate suggestions for how to properly site monitor probes while considering the design of the target road and/or roadside structures?

Preliminary Response: I think that plume dispersion modeling including NO-NO2 chemistry would be very beneficial in identifying the expected location of peak NO2 concentrations for different meteorological conditions. This could also be done using NO2 measurement transects near roadways for a range of meteorological scenarios (morning and evening rush hours, different seasons, different wind speeds, etc.). The general recommendation of the TAD is to place the site as close to the roadway as possible and as low-altitude as possible (2 m), but this may not be where NO2 concentrations are highest because of the time lag for NO conversion to NO2.

Charge Question 6: Does the AMMS believe that Section 8 has adequately discussed and explained the varied approaches on the optional use of exploratory monitoring as part of the near-road site selection process?

Preliminary Response: I think that it's important to emphasize the need for exploratory monitoring over a range of meteorological conditions expected to cause high NO2 (see response to Charge Question 5). PSDs seem useless for this purpose because of the multi-day integration time (as opposed to the 1-h metric of the NAAQS) and this could be better recognized. It seems to me that the best approach is with a mobile unit doing transects parallel to and normal to the highway under traffic and meteorological conditions where maximum NO2 is expected. If it is difficult to make NO2 measurements from a mobile unit with high temporal resolution, the aerosol number concentration could be used as a tracer instead (although that would not factor in the time lag for NO-to-NO2 conversion, see response to Charge Question 5).

Charge Question 7: Within Section 9, does the AMMS see opportunities to improve the description of how the (optional) use of AERMOD and MOVES can be used to conduct dispersion modeling in the near-road site selection process?

Preliminary Response: Tier 3 AERMOD modeling including NO-NO2 chemistry seems essential. Treating NO2 as inert or assuming a fixed NO2/NOx ratio is inadequate – that ratio is expected to greatly vary downwind of highways. The contribution of nearby highway sources to the upwind background should also be recognized.

Charge Question 8: Within Section 10, does the AMMS believe the list of items needed to appropriately characterize individual candidate road sites is complete and adequately described? If the list is considered incomplete, please provide a list of the missing characteristics that should be included.

Preliminary Response: I have no expertise on this.

Charge Question 9: From an air agency perspective, does the AMMS find that the definitions and explanation of transportation agency policies and expectations are adequate? Are there opportunities to improve upon the material presented within this section?

Preliminary Response: I have no expertise on this.

Charge Question 10: Does the AMMS have ideas for improvement with respect to the organization and usefulness of the suggested site comparison matrix discussed within Section 13?

Preliminary Response: There may be the need to better consider the role of nearby roads in contributing to the NO2 background. This could be very important. See my response to Charge Question 2.

Charge Question 11: Does the AMMS:
a. Concur with the order of presentation of each pollutant or metric of interest in the near-road environment, as was suggested by the previous AMMS panel, within Section 14?

Preliminary Response: I suggest giving a higher priority to ozone because of its value of interpreting NO2 in terms of the effect of NO-NO2 titration (higher ozone leading to higher NO2). I would also suggest including NO if possible, for the same reason and with even more importance (NOx = NO+NO2 could be viewed as a conserved tracer on the time scales of interest).

b. Concur with the description of each pollutant or other metric discussed in Section 14, including its impact on human health (as appropriate), the reason for interest in the near-road environment, and the description or suggestions for measurement?

Preliminary Response: I think that the (marginal) interest of SO2 is that it can provide a signature on point source background influences on the site. This could be stated.

c. Believe that a pollutant or other metric should be removed from the list within Section 14, or that an unlisted item should be included within this section?

Preliminary Response: I would remove Pb (this is not a roadway pollutant anymore). I would add NO (see response to a).

Preliminary Comments from Dr. Peter H. McMurry

General Comments/Overview:

Overall, I found the document to be well written. I feel that it provides very clear guidance to state, local and tribal agencies for factors that need to be considered as they proceed towards implementation of near-road NO2 monitoring stations before January 1, 2013.

The goal is to measure exposure hot-spots in the vicinity of roadways. This will be accomplished by sampling NO2 at fixed locations. In addition to measuring NO2, agencies are encouraged to consider a multi-pollutant sampling strategy that would include other species that are emitted by vehicles.

I have two observations that might bear consideration:

•The document does not address exposures of vehicle passengers. While those exposures would likely be for short periods, the short-term exposures could be significantly higher than for residence living downwind of roadways. For example, concentrations of NO2 within tunnels or above below-grade highways might be considerably greater than concentrations 20 to 50 m downwind of highways. It might be a good idea to state explicitly that the document does not apply to exposures of vehicle passengers.

•The document provides guidance on factors that should be avoided when selecting sampling sites (e.g., try not to sample on a side of the roadway that is predominantly upwind; do not sample downwind of elevated roadways on pilings, etc.) I think, however, agencies would also benefit from a clear statement of measurement objectives. For example, is the objective to locate the sampler at a site that would measure the maximum concentrations to which residents might be exposed, or is it to find a site that meets the guidelines specified in the TAD yet leads to the minimum value of the measured concentration (i.e. the fewest exceedences)?

For example, on p. 6-8 the document states "Another example might be considering roads through valleys, where, due to the increased potential for inversion conditions within the valley, higher near-road NO2 concentrations may be found than what is found along alignments on the tops of hills, along hillsides, or in open terrain." Would it be good or bad to locate a sampling site in such a location?

Specific Comments:

<u>Section 6. Physical considerations for candidate near-road monitoring sites.</u>

Figures 6-1 and 6-2 illustrate the impact of roadway design on downwind concentration profiles. These observations show clearly that measured concentrations are strongly dependent on downwind distance within about the first 100 m from the road's edge. The guidelines are for sampling sites to be located a distance of preferably within 20 m and not more than 50 m from the road's edge.

Published data for pollutants that might reasonably be assumed to be conserved near the roadway (e.g., CO) show that, concentrations might be expected to decrease by roughly a factor of two as the sampling location moves from 20 to 50 m (see, e.g., Figure 2 in Zhang et al. (2005). Given the tolerances specified in NAAQSs, a factor of two is significant. Agencies should be given some guidance: should they preferentially site sampling locations 50 m from the road to avoid exceedences, or should they put them 20 m or less from the road (if possible) to ensure that maximum concentrations are obtained within the constraints provided by this TAD?

I do not feel that Figure 6-2 is consistent with actual measurements of "20 nm particles" downwind of roadways, and I recommend that it be replaced or deleted. First, in the atmosphere one would not carry out studies with monodisperse (e.g., 20 nm) particles. Instead, one would measure distribution functions and report concentrations of particles in a specified size interval (e.g., 15 to 25 nm). Also, the results shown in this figure are not representative of particle decay rates downwind of roadways for particles in the 20 nm size range. For example, Zhu et al. (2002) show that concentrations of 6 to 25 nm particles decay much more rapidly with distance than concentrations of particles in other size ranges (25 to 50 nm; 50 to 100 nm; 100 to 220 nm). This observation has been extensively discussed (Zhang et al. 2004; Jacobson et al. 2005; Zhu et al. 2009). It is the consensus of these researchers that concentrations of the smallest particles decrease more rapidly than concentrations of conserved pollutants due to (i) evaporation, and (ii) enhanced multimodal coagulation rates of the small particles as their size decreases by evaporation. Figure 6-2 does not discuss what is known about the behavior of 20 nm particles downwind of roadways, and might imply that they can reasonable be regarded as conserved. This would be inappropriate for this document.

Also for Figures 6-1 and 6-2, information on wind direction relative to the roadway should be mentioned.

References are not given. I assume Baldauf et al. (2009) is an EPA report. Baldauf and coworkers have also written some peer reviewed journal articles (Hagler et al. 2009). I would encourage you to also refer to the papers by Zhu and coworkers. Their size-resolved measurements provide a better understanding of size-dependent concentration profiles downwind of freeways.

Section 7. Siting Criteria

My principle concern with this section is summarized above. The agencies need to be provide clear guidance: what is the measurement goal? The TAD leaves quite a bit of room for interpretation, and the resulting outcome may vary significantly given the strong dependence of concentrations on the sampling site chosen.

Details:

Section 8.2 requires careful editing.

References Cited:

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Jacobson, M. Z., D. B. Kittelson and W. F. Watts (2005). "Enhanced coagulation due to evaporation and its effect on nanoparticle evolution." Environmental Science & Technology 39: 9486-9492.

Zhang, K. M., A. S. Wexler, D. A. Niemeier, Y. F. Zhu, W. C. Hinds and C. Sioutas (2005). "Evolution of particle number distribution near roadways. Part III: Traffic, analysis and on-road size resolved particulate emission factors." Atmospheric Environment 39(22): 4155-4166.

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Zhu, Y., J. Pudota, D. Collins, D. Allen, A. Clements, A. DenBleyker, M. Fraser, Y. Jia, E. McDonald-Buller and E. Michel (2009). "Air pollutant concentrations near three Texas roadways, Part I: Ultrafine particles." Atmos. Environ. 43: 4513-4522.

Zhu, Y. F., W. C. Hinds, S. Kim, S. Shen and C. Sioutas (2002). "Study of ultrafine particles near a major highway with heavy-duty diesel traffic." Atmospheric Environment 36(27): 4323-4335.

Preliminary Comments from Dr. Jamie Schauer

Charge Question 1: Does the TAD, particularly based upon the information provided in Sections 1 and 2, provide clear objectives of the document and give appropriate rationale for the objectives?
Preliminary Response: Section 1 seems like a good place to briefly note the health studies that have shown health risk of residing and traveling near roadways. This provides a strong motivation to approach near-road exposures from a multi-pollutant perspective.

Charge Question 2: Does the AMMS believe that the suggested approach in the TAD places an appropriate amount of weight and consideration on all six factors (AADT, fleet mix, congestion patterns, roadway design, terrain, and meteorology) required to be considered as part of the near-road NO2 site selection process?
Preliminary Response: The weight of factors seems appropriate in the context of TAD

Charge Question 3: Does the AMMS see opportunities to improve the usefulness of the Fleet Equivalent AADT metric introduced and discussed within Section 5?
Preliminary Response: I would recommend providing more information on calculating the HD_m. The current write up seems to suggest that the national default value is good enough and does not really provide incentive or motivation to have a more site specific value. I would recommend site specific values where possible.

Charge Question 4: Within Section 6, does the AMMS believe we have adequately described the effects of roadway design, roadway structures, terrain, and meteorology on roadway pollutant dispersion and suggested how those effects can be considered in the near-road site selection process?
Preliminary Response: Given the target audience, I think this section is appropriate in terms of the scope and level of detail.

Charge Question 5: Within Section 7, does the AMMS believe we have adequately discussed the siting requirements and provided appropriate suggestions for how to properly site monitor probes while considering the design of the target road and/or roadside structures?
Preliminary Response: Given the target audience, I think this section is appropriate in terms of the scope and level of detail.

Charge Question 6: Does the AMMS believe that Section 8 has adequately discussed and explained the varied approaches on the optional use of exploratory monitoring as part of the near-road site selection process?
Preliminary Response: This section may be more useful if a summary of the pros and cons of the different exploratory monitoring approaches were explicitly stated and summaries.

Charge Question 7: Within Section 9, does the AMMS see opportunities to improve the description of how the (optional) use of AERMOD and MOVES can be used to conduct dispersion modeling in the near-road site selection process?
Preliminary Response: None

Charge Question 8: Within Section 10, does the AMMS believe the list of items needed to appropriately characterize individual candidate road sites is complete and adequately described? If the list is considered incomplete, please provide a list of the missing characteristics that should be included.

Preliminary Response: In this section and in the report in general, it seems that some characterization of the roadway grade (i.e. incline or decline) needs to be considered. Clearly, this will have a significant impact on HDD emissions.

Charge Question 9: From an air agency perspective, does the AMMS find that the definitions and explanation of transportation agency policies and expectations are adequate? Are there opportunities to improve upon the material presented within this section?

Preliminary Response: No suggestions to improve

Charge Question 10: Does the AMMS have ideas for improvement with respect to the organization and usefulness of the suggested site comparison matrix discussed within Section 13?

Preliminary Response: No suggestions to improve

Charge Question 11: Does the AMMS:

a. Concur with the order of presentation of each pollutant or metric of interest in the near-road environment, as was suggested by the previous AMMS panel, within Section 14?

b. Concur with the description of each pollutant or other metric discussed in Section 14, including its impact on human health (as appropriate), the reason for interest in the near-road environment, and the description or suggestions for measurement?

c. Believe that a pollutant or other metric should be removed from the list within Section 14, or that an unlisted item should be included within this section?

Preliminary Response: In section 14.7 concerning PM, it may be useful to explain the relative roadway sources that impact PM2.5 versus Coarse PM (PM10-PM2.5). They key point is that brake wear, tire wear and resuspended road dust will impact will largely be Coarse PM and tailpipe emissions will largely be submicron PM.

Preliminary Comments from Dr. Jay Turner

Charge Question 1. Does the TAD, particularly based upon the information provided in Sections 1 and 2, provide clear objectives of the document and give appropriate rationale for the objectives?

Preliminary Response: The objectives are generally clear. It might be helpful to directly include excerpts from the final rule such as section 4.3 from Appendix D of Part 58 and the revisions to Appendix E of Part 58. These sections could be appended to the TAD or in some cases excerpts could be added as text boxes to the main body to reinforce the requirements and constraints to the monitor siting approach that are imposed by the regulation. These issues are discussed throughout the TAD with reference to the final rule, but in some cases it would be helpful to have the formal language handy.

Charge Question 2. Does the AMMS believe that the suggested approach in the TAD places an appropriate amount of weight and consideration on all six factors required to be considered (AADT, fleet mix, congestion patterns, roadway design, terrain, and meteorology) as part of the near-road NO2 site selection process?

Preliminary Response: It is understandable that the required approach starts with AADT and builds in the additional factors because AADT data should be readily available for all affected areas. On the other hand, many areas have time-resolved traffic data and the TAD provides no clear vision for how these data could be most effectively incorporated into the ranking process. Congestion metrics such as level of service (LOS) partially capture the within day dynamics but this is a rather coarse grained metric and cannot be used to refine the prioritization of roadway segments with the same LOS. Indeed, the Tampa example demonstrates that the vast majority of road segments ranked in the top 30 have an F ranking for the LOS. In light of this issue, if hourly data are available then an additional useful metric may be the daily maximum hourly traffic volume (better yet, the daily maximum hourly fleet equivalent hourly traffic volume).

Can the EPA offer any guidance on how to cluster the ranked results? For example, the Tampa example provides a ranked list. Can approaches be taken subsequently group the segments into highest priority, moderate priority, and lowest priority? Clearly there are no bright lines for making such distinctions but on the other hand the rank ordering of road segments should not be overly interpreted given the subjective linkage between the ranking criteria and maximum hourly NO2 concentrations.

The TAD clearly describes the criteria for determining whether a second monitor is required (e.g. Figure 3-1). However, the objectives for the second monitor should be discussed in more detail. The final rule states "Where one CBSA is required to have two near-road NO2 monitoring stations, the sites shall be differentiated from each other by one or more of the following factors: fleet mix; congestion patterns; terrain; geographic area within the CBSA; or different route, interstate, or freeway designation." At a minimum this description should be provided with additional guidance offered if possible.

It would be helpful to provide additional guidance on whether and how background concentrations should be considered. Background concentrations are mentioned throughout the document but it would be helpful to discuss its role in the site selection process in more detail given many of the high traffic roadways may be in proximity to other roadways such as a road segments within an urban core transportation network. The emphasis clearly is on impacts from the adjacent roadway. The TAD discusses impacts from nearby point sources and such but it would be helpful to step back and reflect upon the role of background concentrations when assessing candidate monitoring sites.

Charge Question 3. Does the AMMS see opportunities to improve the usefulness of the Fleet Equivalent AADT metric introduced and discussed within Section 5?

Preliminary Response: Overall, I like the approach as a screening tool. Of course the use of road-segment specific fleet mix would be ideal but it is respected these data are not available in all affected areas. In the absence of such data, the approach will likely need to be more thoughtful than the "county by county characterization" mentioned on page 5-13 as one possible approach to fleet mix categorization. Additional guidance should be provided on approaches that could be taken to assign fleet mixes to road segments in the absence of segment-specific data.

The nomenclature could be improved to provide clarity. For example, the term "Fleet Equivalent (FE) AADT" is vague. It is actually a light duty (LD) vehicle equivalent measure because the heavy duty vehicle counts are being scaled to the number of equivalent light duty vehicles in terms of emissions. Second, the HD-to-LD emission ratio is represented by HDm and the HD annual average daily traffic count is HDc. The notation for these two variables is too similar. Consider representing HDm as (EFHD)/(EFLD) where EFi is a representative emission factor for vehicle class i.

Charge Question 4. Within Section 6, does the AMMS believe we have adequately described the effects of roadway design, roadway structures, terrain, and meteorology on roadway pollutant dispersion and suggested how those effects can be considered in the near-road site selection process?

Preliminary Response: It seems that intersections/interchanges could be hot spots for NO2 concentrations. The ranking methodology focuses on roadway segments and gives too little attention to the confluence of roadway segments as being an important consideration. It is merely mentioned as a "desirable attribute" in Section 6 and one of the field characteristics that should be documented (Section 10.4) but should be given much more weight in the prioritization. Using the Tampa example, do two of the ranked segments represent a crossing of some type? If so, they should be collectively made a higher priority.

The guidance states that air channeling by terrain should be considered. The emphasis is on the macro-scale rather than the micro-scale such as air channeling by along cut-section roadways. It might be useful to clarify that the distinction between seeking to capture high near-roadway concentrations versus high on-roadway concentrations.

Charge Question 5. Within Section 7, does the AMMS believe we have adequately discussed the siting requirements and provided appropriate suggestions for how to properly site monitor probes while considering the design of the target road and/or roadside structures?

Preliminary Response: The discussion is generally fine. The criteria are necessarily subjective in the absence of very detailed air flow modeling. The last sentence of Section 7 is not clear – what is meant by the agencies should "consider more than one linear pathway between the target road segment and the monitor probe"? This issue is discussed earlier in the section but this summary sentence does not bring the discussion together.

Charge Question 6. Does the AMMS believe that Section 8 has adequately discussed and explained the varied approaches on the optional use of exploratory monitoring as part of the near-road site selection process?

Preliminary Response: This section provides some discussion of the context for conducting exploratory monitoring and could be more fully developed. It is stated that exploratory monitoring may be useful to compare and contrast sites that are ranked as high priority locations. Within this context, another example would be the case of intersections or interchanges between two road segments that were each ranked moderately high to determine whether their additive effects significantly increase their ranking. This would best be done by exploratory monitoring or modeling of the highest-ranks sites and these cases of intersections/interchanges, with the former needed for to provide context for the interpreting the latter.

Charge Question 7. Within Section 9, does the AMMS see opportunities to improve the description of how the (optional) use of AERMOD and MOVES can be used to conduct dispersion modeling in the near-road site selection process?

Preliminary Response: I will address this charge question in more detail in my final comments.

One area that could be refined is the section on urban/rural classification in Section C.6.3. In the discussion of Figure 6-1 it is stated that "urban and rural concentrations are nearly equal at short distances but as distance from the source increases, the urban concentrations become much less than the rural concentrations." This figure and the level of detail in the subsequent

text are certainly important if sources in addition to the road segment are being modeled. However, if only the road segment is being modeled then, as stated, the differences are insignificant over the spatial scales of interest for siting the monitor (within 50 m). This conclusion needs to be highlighted.

Charge Question 8. Within Section 10, does the AMMS believe the list of items needed to appropriately characterize individual candidate road sites is complete and adequately described? If the list is considered incomplete, please provide a list of the missing characteristics that should be included.

Preliminary Response: To be addressed in my final comments.

Charge Question 9. From an air agency perspective, does the AMMS find that the definitions and explanation of transportation agency policies and expectations are adequate? Are there opportunities to improve upon the material presented within this section?

Preliminary Response: Section 11 discusses the monitor site logistics including the need to coordinate with appropriate transportation agencies. In each of the affected areas there already exists a forum for exchanging information – transportation and air quality planning coordination required through the designated Metropolitan Planning Organization. As discussed in Section 11 the coordination will often go far beyond the transportation and air quality management planning level because instruments such as access agreements and permits may be involved. The bullet lists in Section 11.4 provide a reasonable overview of the key considerations.

Charge Question 10. Does the AMMS have ideas for improvement with respect to the organization and usefulness of the suggested site comparison matrix discussed within Section 13?

Preliminary Response: The comparison matrix provides a nice framework. While this is not a strictly prioritized list, I believe the presence of interchanges/intersections should be moved up the table (e.g., immediately follow Congestion Information) and specifically call out cases where the crossing road segment is highly ranked.

For the meteorology parameter, the description should include a qualitative indicator of the likely representativeness of the data used. For example, if the data are from the area's airport and the site characteristics would lead one to believe such data may not be representative for the specific road segment, this should be qualified. In particular, attributes that increase the frequency of calm conditions should be mentioned.

Charge Question 11. Does the AMMS: (a) Concur with the order of presentation of each pollutant or metric of interest in the near-road environment, as was suggested by the previous AMMS panel, within Section 14? (b) Concur with the description of each pollutant or other metric discussed in Section 14, including its impact on human health (as appropriate), the reason for interest in the near-road environment, and the description or suggestions for measurement? (c) Believe that a pollutant or other metric should be removed from the list within Section 14, or that an unlisted item should be included within this section?

Preliminary Response: I am comfortable with the ranked list with the following exception. Is Section 14.8 intended to be Organic Carbon in general – including both gaseous and PM species – or exclusively PM? The title and first sentence suggest the former but the remainder of the section focuses on particulate matter OC with key gaseous species addressed in Section 14.12 (Air Toxics). Also, mention of the HR-AMS seems inappropriate because it is strictly a research grade instrument. If anything, the ACSM would be a better instrument to mention in this context.

Section 14 should start with a list or table of the pollutants and metrics. My final comments will include suggestions for refining some of these pollutant-specific summaries. For example, the second paragraph of Section 14.7 (PM Mass) can be tightened up and I will provide specific suggestions.

My final comments will include suggestions for revising the presentation and wording in a various places throughout the entire document to improve clarity.

Preliminary Comments from Dr. Yousheng Zeng

Charge Question 1 – Objectives and rationale

Preliminary Response: The draft TAD does provide clear objectives of the document.

Charge Question 2 – Weight and considerations on six factors in the site selection process

Preliminary Response: I believe that the TAD places appropriate amount of weight and consideration on all six factors. However, I think EPA should add some factors for consideration in the site selection process. These factors are not specified in 40 CFR 58 App. D, but they may influence the monitoring results or the use of the results. These factors may include:

1. Cumulative effect of multiple roadways. The site selection process discussed in the draft TAD focuses on individual roadways. They are treated as isolated roadways. In actual environment, if there are multiple roadways in very close proximity (e.g., a freeway segment in a city that is parallel to two major streets (not frontage roads), one on each side 100 meters away from the freeway. When evaluated individually, each of them may not be ranked high. However, the combined effect of these roadways can be significantly higher.
2. Nearby NO_2 stationary point or area sources.
3. Public accessibility. As stated in the TAD, the near-road monitor should be placed within 50 meters from the outer lane of the roadway. If there is no public access to the 50-m zone for a roadway segment (e.g., barbwire/fence along the roadway, natural terrain, etc., or combination of these), this segment should not be considered for monitoring even when the AADT is very high. The test of public accessibility for definition of "ambient air" has been a long-standing policy in the EPA PSD permit program. The same policy should be adopted for near-road NO2 monitoring.
4. Nearby residents. If there are two candidate sites ranked about the same and one is surrounded by residents and the other is not, the one with nearby residents should be given more consideration for monitoring.

The TAD should discuss the nature and effect of these factors; provide guidance on how to treat them in the site selection process and how to document them in the monitoring plans.

Charge Question 3 – FE AADT metric

Preliminary Response: Use of Fleet Equivalent AADT to normalizing fleet mix (i.e., converting HD vehicle traffic to equivalent LD vehicle traffic) and compare road segments on

the normalized, FE AADT, basis is a significant improvement over the method based on AADT. There might be ways to further classify vehicle types beyond the two classes (i.e., HD and LD). However, I think the method proposed in the draft TAD is most practical and adequate for most cases. For certain road segments (e.g., highway in Central Business Districts) where no HD vehicles are allowed, the monitoring agency can simply make AADT=FE AADT.

The draft TAD provides step-by-step procedures. However, the issue of multiple roadways in close proximity (see discussion and example above in response to Charge Question 2) is not addressed in the FE AADT based ranking scheme described in the draft AADT. Some high NO_2 areas may be missed.

There are cases where the median between divided highways is very wide. Should each direction be treated as a separate roadway in the ranking? If so, how wide does the median have to be in order to be treated as separate roadways?

Charge Question 4 – Roadway pollutant dispersion

Preliminary Response: The opening part of Section 6 and Table 6 provide a summary of the three factors that affect pollutant dispersion. Although the impact of these factors to dispersion is adequately described, the guidance on how to factor in the impact is not very clear. Should a monitoring site be selected so that the highest NO_2 concentration (the worst dispersion) is detected or avoided? It appears that conflicting message is given: sometimes the idea is to detect the highest near road pollutant concentrations; and other times the guidance is to avoid the worst dispersion conditions (e.g., presence of sound walls). It would be very helpful that the principle used in dealing with these dispersion factors is clearly explained in the opening part of Section 6.

Charge Question 5 – Siting requirements and monitoring probe

Preliminary Response: Section 7, specifically Table 7, provides a good summary of the regulatory requirements. Recommendations are specific and easy to follow. One area that may need further discussion is the relationship between the probe horizontal and vertical placement. The horizontal placement and vertical placement are discussed separately. Should there be a discussion on the interplay between the two? There is a range in both dimensions: horizontally from "as near as practicable" to 50 meters; vertically from 2 meters to 7 meters. When the horizontal distance is very close to the traffic, should the vertical distance be in the lower range, closer to 2 meters, rather than the higher range, closer to 7 meters? Under a strong, perpendicular wind condition, the plume coming out of the tailpipe will be low and will gradually disperse as distance increases. Therefore at a very short horizontal distance from traffic, the plume may be very low and a probe intake position near 7 meters may be too high to intercept with the plume.

If the probe is placed further away from traffic (further distance downwind from the traffic), the plume will be better dispersed, and a higher probe position may not be a significant issue.

It may also be a good idea to discuss the sample line length. If the probe intake is 7-meter high and the analyzer is at the ground level, there may be a long sample line running from the probe intake to the analyzer. A long sample line may cause issues in response time or loss of target compounds. Some guidance on either sample line length or sample residence time in the line should be provided.